

Claims:

1. A synthetic middle distillate cut comprising more than 50% isoparaffins, wherein the isoparaffins are predominantly methyl and/or ethyl and/or propyl branched.
2. A synthetic middle distillate cut as claimed in claim 1, wherein the gradient of an isoparaffins to n-paraffins mass ratio profile of the synthetic middle distillate cut increases from about 1:1 for C₈ to 8.54:1 for C₁₅ and decrease again to about 3:1 for C₁₈.
3. A synthetic middle distillate cut as claimed in claim 1 or claim 2, wherein a fraction of the synthetic middle distillate cut in the C₁₀ to C₁₈ carbon number range has a higher ratio of isoparaffins to n-paraffins than a C₈ to C₉ fraction of the synthetic middle distillate cut.
4. A synthetic middle distillate cut as claimed in any one of claims 2 to 3, wherein the isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction is between 1:1 and 9:1.
5. A synthetic middle distillate cut as claimed in any one of claims 2 to 4, wherein the isoparaffins to n-paraffins mass ratio is about 8.54:1 for a C₁₅ fraction of the synthetic middle distillate cut.
6. A synthetic middle distillate cut as claimed in any one of claims 2 to 5, wherein a C₁₉ to C₂₄ fraction of the middle distillate cut has a narrow mass ratio range of isoparaffins to n-paraffins of between 3.3:1 and 5:1.
7. A synthetic middle distillate cut as claimed in any one of claims 2 to 5, wherein a C₁₉ to C₂₄ fraction of the middle distillate cut has a narrow mass ratio range of isoparaffins to n-paraffins of between 4:1 and 4.9:1.
8. A synthetic middle distillate cut as claimed in any one of the preceding claims, wherein the mass ratio of isoparaffins to n-paraffins is adjustable by controlling the blend ratio of hydrocracked to straight run components of the synthetic middle distillate cut.
9. A synthetic middle distillate cut as claimed in claim 8, wherein the isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction having 30% straight run component is between 1:1 and 2:5:1.
10. A synthetic middle distillate cut as claimed in claim 8, wherein the isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction having 20% straight run component is between 1.5:1 and 3:5:1.
11. A synthetic middle distillate cut as claimed in claim 8, wherein the isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction having 10% straight run component is between 2.3:1 and 4.3:1.
12. A synthetic middle distillate cut as claimed in claim 8, wherein the isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction having substantially only a hydrocracked component is between 4:1 and 9:1.

13. A middle distillate cut as claimed in any one of the preceding claims, wherein at least some of the isoparaffins are methyl branched.
14. A middle distillate cut as claimed in any one of the preceding claims, wherein at least some of the isoparaffins are di-methyl branched.
- 5 15. A middle distillate cut as claimed in any one of the preceding claims, wherein at least 30% (mass) of the isoparaffins are mono-methyl branched.
16. A middle distillate cut as claimed in any one of claims 1 to 15, wherein at least some of the isoparaffins are ethyl branched.
17. A middle distillate cut as claimed in any one of the preceding claims, wherein the ratio of isoparaffins to n-paraffins mass ratio is between about 1:1 to about 12:1.
- 10 18. A synthetic middle distillate cut as claimed in claim 17, wherein the isoparaffins to n-paraffins mass ratio is between about 2:1 to about 6:1.
19. A synthetic middle distillate cut as claimed in claim 18, wherein the isoparaffins to n-paraffins mass ratio is 4:1.
- 15 20. A synthetic middle distillate cut as claimed in any one of the preceding claims, having a light fraction in the boiling range 160°C to 270°C wherein the isoparaffins to n-paraffins mass ratio is between 1:2 and 4:1.
21. A synthetic middle distillate cut as claimed in claim 20, having a light fraction in the boiling range 160°C to 270°C wherein the isoparaffins to n-paraffins mass ratio is 2.2:1.
- 20 22. A synthetic middle distillate cut as claimed in any one of the preceding claims, having a heavy fraction in the boiling range 270°C to 370°C wherein the isoparaffins to n-paraffins mass ratio is between 4:1 and 14:1.
23. A synthetic middle distillate cut as claimed in claim 22, having a heavy fraction in the boiling range 270°C to 370°C wherein the isoparaffins to n-paraffins mass ratio is 21:2.
- 25 24. A synthetic middle distillate cut having a Cetane number above 70 and a CFPP, in accordance with IP 309, of below -20°C, said distillate having an isoparaffinic content substantially as claimed in any one of claims 1 to 23.
25. A synthetic middle distillate cut as claimed in any one of claims 1 to 24, wherein the synthetic distillate is derived from one or more FT primary product.
- 30 26. A diesel fuel composition including from 10% to 100% of a middle distillate cut as claimed in any one of the preceding claims. ②
27. A diesel fuel composition as claimed in claim 26, including from 0 to 90% of one or more other diesel fuel.
28. A diesel fuel composition as claimed in claim 26, including from 20 to 80% of one or more other diesel fuel.
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29. A diesel fuel composition as claimed in any one of claims 26 to 28, including at least 20% of the middle distillate cut, the composition having a Cetane number greater than 47 and a CFPP, in accordance with IP 309, below -22°C .
30. A diesel fuel composition as claimed in claim 26, including at least 30% of the middle distillate cut, the composition having a Cetane number greater than 50 and a CFPP, in accordance with IP 309, below -22°C .
31. A diesel fuel composition as claimed in claim 26, including at least 50% of the middle distillate cut, the composition having a Cetane number greater than 52 and a CFPP, in accordance with IP 309, below -25°C .
32. A diesel fuel composition as claimed in claim 26, including at least 70% of the middle distillate cut, the composition having a Cetane number greater than 60 and a CFPP, in accordance with IP 309, below -30°C .
33. A diesel fuel composition as claimed in any one of claims 26 to claim 32, including from 0 to 10% additives.
34. A diesel fuel composition as claimed in claim 33, wherein the additives include a lubricity improver.
35. A diesel fuel composition as claimed in claim 34, wherein the lubricity improver comprises from 0 to 0.5% of the composition.
36. A diesel fuel composition as claimed in claim 35, wherein the lubricity improver comprises from 0.00001% to 0.05% of the composition.
37. A diesel fuel composition as claimed in claim 36, wherein the lubricity improver comprises from 0.008% to 0.02% of the composition.
38. A diesel fuel composition as claimed in any one of claims 28 to 37, wherein one of the other diesel fuels is US 2-D grade diesel fuel.
39. A diesel fuel composition as claimed in any one of claims 28 to 37, wherein one of the other diesel fuels is CARB grade diesel fuel.
40. A process for producing a synthetic middle distillate having a Cetane number higher than 70, the process including:
 - (a) separating the products obtained from synthesis gas via a FT synthesis reaction into one or more heavier fraction and one or more lighter fraction;
 - (b) catalytically processing the heavier fraction under conditions which yield mainly middle distillates;
 - (c) separating the middle distillate product of step (b) from a light product fraction and a heavier product fraction which are also produced in step (b); and
 - (d) blending the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof.

41. A process for producing a synthetic middle distillate as claimed in claim 40, wherein the catalytic processing of step (b) is a hydroprocessing step.
42. A process for producing a synthetic middle distillate as claimed in claim 40 or claim 41, including one or more additional step of fractionating at least some of the one or more lighter fraction of step (a), or products thereof, prior to step (d).
43. A process for producing a synthetic middle distillate as claimed in any one of claims 40 to 42, including the additional step of hydrotreating at least some of the one or more light fraction of step (a), or products thereof, prior to step (d).
44. A process for producing a synthetic middle distillate as claimed in any one of claims 30 to 43, wherein the one or more heavier fraction of step (a) boils above about 270°C.
45. A process for producing a synthetic middle distillate as claimed in 44, wherein the one or more heavier fraction of step (b) has a isoparaffins to n-paraffins mass ratio of between 4:1 and 14:1.
46. A process for producing a synthetic middle distillate as claimed in 45, wherein the one or more heavier fraction of step (b) has a isoparaffins to n-paraffins mass ratio of 21:2.
47. A process for producing a synthetic middle distillate as claimed in any one of claims 30 to 46, wherein the one or more heavier fraction of step (a) boils above about 300°C.
48. A process for producing a synthetic middle distillate as claimed in any one of claims 30 to 47, wherein the one or more lighter fraction boils in the range C₅ to the boiling point of the heavier fraction.
49. A process for producing a synthetic middle distillate as claimed in any one of claims 30 to 48, wherein the one or more lighter fraction boils in the range 160°C to 270°C.
50. A process for producing a synthetic middle distillate as claimed in any one of claims 48 or 49, wherein the one or more lighter fraction has an isoparaffins to n-paraffins mass ratio of between 1:2 and 4:1.
51. A process for producing a synthetic middle distillate as claimed in any one of claims 48 to 50, wherein the one or more lighter fraction has an isoparaffins to n-paraffins mass ratio of 2.2:1.
52. A process for producing a synthetic middle distillate as claimed in any one of claims 40 to 51, wherein the product of step (d) boils in the range 100°C to 400°C.
53. A process for producing a synthetic middle distillate as claimed in any one of claims 40 to 52, wherein the product of step (d) boils in the range 160°C to 370°C.
54. A process for producing a synthetic middle distillate as claimed in any one of claims 40 to 53, wherein the product of step (d) is a diesel fuel.
55. A process for producing a synthetic middle distillate as claimed in any one of claims 40 to 54, wherein the product of step (d) has a CFPP below -20°C.
56. A process for producing a synthetic middle distillate as claimed in claim 54, wherein the product of step (d) has a CFPP below -30°C.
57. A process for producing a synthetic middle distillate as claimed in claim 56, wherein the product of step (d) has a CFPP below -35°C.
58. A process for producing a synthetic middle distillate as claimed in any one of claims 40 to 57, wherein the product of step (d) is obtained by mixing the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof, in a volume ratio selected to provide a diesel fuel having a required specification.

59. A process for producing a synthetic middle distillate as claimed in any one of claims 40 to 58, wherein the product of step (d) is obtained by mixing the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof, in a volume ratio of between 1:1 and 9:1.
- 5 60. A process for producing a synthetic middle distillate as claimed in claim 59, wherein the product of step (d) is obtained by mixing the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof, in a volume ratio of between 2:1 and 6:1.
61. A process for producing a synthetic middle distillate as claimed in any one of claims 58 to 60, wherein the product of step (d) is obtained by mixing the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof, in a volume ratio of 84:16.
- 10 62. A synthetic middle distillate cut, substantially as herein described and illustrated.
63. A diesel fuel composition, substantially as herein described and illustrated.
64. A process for producing a synthetic middle distillate having a Cetane number higher than 70, substantially as herein described and illustrated.
- 15 65. A new synthetic middle distillate cut, a diesel fuel composition, or a new process for producing a synthetic middle distillate having a Cetane number higher than 70, substantially as herein described.